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GEOGRAPHICAL ENVIRONMENT AND JAPANESE CHARACTER

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Individuals may determine the details of history, but its great movements depend upon the character of races. In no country is this truer than in Japan. She has not risen to the position of a world-power through the exertions of any single individual, but because her people possess a character comparable to that of the nations of Europe. In order to understand Japan's history and the present position of the island empire it is necessary to investigate the causes which have produced a character different from that of any other Asiatic nation. The problem is essentially biological and must be treated like other biological problems. External influences such as the Buddhist religion, Chinese ideals in art, literature and social life, European methods in commerce, war and government are doubtless highly important, but back of them and long antedating them, lie the mental traits which have made the Japanese able so quickly and effectively to assimilate and improve upon foreign ideas. These mental traits cannot be dismissed merely as unexplained racial characteristics. They must have arisen in accordance with the fixed laws of nature; and only by discovering these laws can the Japanese or any other race hope to accelerate the development of good qualities and to eliminate those that are detrimental.

From the biological, that is the evolutionary point of view, only three theories seem to offer any adequate explanation of the origin of racial characteristics. In the first place such characteristics may have arisen from spontaneous variations, secondly from the intermixture of races, and thirdly from the stimulation and selective action of geographic environment.

The first theory, that of spontaneous variations, finds frequent expression in biological writings. According to it offspring vary from parents for no assignable causes, but simply because of some innate, organic characteristic. In certain species or at certain periods in the history of each species such variations become especially abundant and new varieties or even new species arise. For instance, at the present time the experiments of DeVries and others show that the evening primrose is highly variable and is constantly giving off sports. It is a matter of every-day observation that variations of this kind occur in the human race. Sons differ from fathers and daughters from mothers. Under ordinary circumstances, where the environment remains constant, such variations tend to counteract one another and thus are eliminated in the course of a few generations. It is possible, nevertheless, that they sometimes keep on in a definite direction without reference to whether the environment is favorable or unfavorable. Thus a new species may perhaps be evolved without the aid of external conditions. How frequently this has taken place, or how important it may be, we cannot tell, for we are dealing here with inferences and not with facts of actual observation. On the other hand we know positively that after variations have once arisen environment picks out certain ones for preservation. No one can question that, other things being equal, a Korean tiger which is not sensitive to dampness or low temperature is more likely to be strong and to reproduce his kind than is one which is forced to seek retreat in a warm cave whenever heavy rain falls or the temperature is low. Similarly one of the chief reasons why the domestic sheep is among the most gregarious and timorous of animals is that for ages the adventurous individuals who were prone to stray from the flock have been killed by wild animals and have left no progeny. Hence, even though variations in a species may arise from some unknown, internal cause, their preservation is almost entirely a matter of environment. Moreover it is quite possible that the supposed spontaneous variations are due to some external cause. For example, in the case of the primrose with its abnormally high variability,

there is no evidence, so far as our present knowledge goes, that the changes may not be instigated by external stimuli such as peculiar conditions of sunshine, temperature or barometric pressure at critical times in the development of the seed. Or again minute changes in the chemical composition of the sap, as MacDougal has shown, may produce revolutionary changes in the succeeding generation. So commonplace an accident as the dying of a worm among the roots at a critical time may, for all that we know, alter the composition of the sap sufficiently to cause occasional ovules to develop into seeds and plants possessing qualities notably different from those of the parents. Hence even in their origin the so-called spontaneous variations of living beings may be the result of environment, and their preservation is certainly such a result.

Coming now to the second theory, the vast majority of students agree that the immense importance and far-reaching results of the intermixture of races cannot be gainsaid. In general, according to the observations of biologists, the interbreeding of diverse types produces two results. In the first place a race different from either of its ancestors is the immediate and obvious product. In the second place, the individuals of the new race tend to vary widely from the mean. In the case of animals we notice great variations in size, speed, and other physical attributes. In the case of man, since the brain is his most sensitive as well as most important organ, the most notable variations are mental; and a mixed race appears to be characterized not only by individuals of uncommon intellectual brilliancy, but also by an undue proportion of feeble-minded. In spite of the importance of the intermixture of races, however, there are certain facts which tend to show that its importance is much reduced by the operation of environment. In the first place hybridization between closely allied races such as the English and Germans cannot be expected to produce any very striking results since the original characteristics of the two races are closely similar. The most marked effects of crossing are found where diverse races intermingle, but here another factor steps in. Not only are hybrids

relatively infertile, but also they tend to be weak in other respects, both physically and morally. Hence they die out rapidly, as the Eurasians, the progeny of European fathers and Asiatic mothers, are doing in India. This principle would seem to apply directly to the Japanese. Various Mongoloid elements might well mingle and produce an enduring race just as the races of Europe appear to be able to mix freely. When it comes to the possibility of an important infusion of Malay blood, or still more of an Aryan admixture, the general principles of biology are distinctly counter to the probability that the progeny of these invaders of highly diverse races would persist for any great length of time.

This second fact which militates against the theory that intermixture of races is the primary factor in the present character of the Japanese depends upon another biological principle. When an alien race invades a new habitat there is not one chance in a hundred that its adaptation to that particular environment will be equal to the adaptation of the original race. In rare cases the newcomers may be better adapted; usually they are at a disadvantage. How important this matter of adaptation is may be judged from the way in which the negro race tends to die off in our northern States in spite of constant immigration from the south. In the same way Scandinavians as a race cannot thrive in the drier, more sunny parts of America. They may succeed for a while, but statistics show that they tend to contract various diseases, especially of the nerves and skin. In the rainy regions on the coast of Oregon and Washington, on the contrary, where the environment resembles that of Scandinavia, they prosper greatly, both in body and estate. In the case of a mixture of races not only the invaders themselves, as a general rule, but also the hybrids which tend toward the type of the newcomers, are distinctly at a disadvantage. So long as they remain a ruling class with unusual opportunities to protect and care for themselves, they may persist, but gradual mixture with other elements of the population is bound to take place, and the type less adapted to the country slowly disappears. It was thus apparently with the energetic fair-haired invaders who are supposed to

have come into Greece and Italy in ancient days from the north. For a while they seem to have been the dominating element and to have been one of the chief causes of the great achievements of the early Greeks and Romans. Today, however, their inability to withstand the dry climate and the ravages of malaria has almost eliminated them in favor of the present less energetic brunette races. In Japan the same process of selection must have gone on during the long period since the supposed Malays or Aryans reached the islands. Possibly the differences of feature and physique which are often said to exist between the upper and lower classes in Japan may preserve the record of an admixture of races ages long ago, but this does not explain why the Japanese, not only of one class but of all, are characterized by a degree of mental alertness much in excess of that of most of the people of Asia including the Chinese.

We come now to the third and last of the reasons for thinking that intermixture of races is not the chief cause of Japan's present advanced position. The variability of mixed races, whether among plants, animals, or man, is greatest immediately after the two parent types come together. Thereafter, not only does the new hybrid race tend, as we have just seen, to revert toward the type best fitted to the environment, but there is a constant tendency for the offspring to vary less and less from the ultimate type which gradually becomes established as the standard. Hence in any race such as the Japanese exceptional mental brilliancy, so far as it is due to racial intermixture, is more frequent immediately after the amalgamation of the races. The Japanese are generally conceded to be remarkable for a high general average of mental development rather than for individuals of exceptional brilliancy. This is what would be expected. However great the amount of mixture of races may have been in Japan, most of it occurred two thousand or more years ago, and it was practically completed twelve hundred years ago. Since then forty generations have elapsed, a length of time sufficient to allow much progress toward the extinction of extreme variability and its accompanying intellectual brilliancy, and also toward approxima-

tion to the type normal to the country. Yet the Japanese show no indications of being less alert now than formerly. It must be borne in mind that the tendency to eliminate characteristics incompatible with physical surroundings is extremely strong. Every one knows how plants which have been produced by careful cross-breeding quickly return to the original type when left to themselves. Similarly among animals the best varieties of cattle or horses quickly revert to a primitive type when allowed to run wild for a few generations. Inasmuch, then, as the Japanese have been without the infusion of new blood for a long time, it would seem from the point of view of the biologist and evolutionist that the race, no matter whether it is much or little mixed, has had a good opportunity to approximate to the type demanded by Japanese environment.

The fact that the Japanese or any other race is mixed and is at the same time brilliant does not by any means prove that the brilliancy is due to the mixture. The Koreans appear to be as mixed as the Japanese; the Chinese of the north with their admixture of Tartar and Manchu blood are more mixed; the Persians and the people of northern India contain as many elements as the Chinese and perhaps more; and probably no race under Heaven is so diverse in its origin as the so-called Turk with his infusion of Tartar, Kurdish, Armenian, Greek and Circasian blood; yet these mixed peoples do not stand particularly high in civilization. Against them may be put the English, Germans, Russians and Americans, all of whom are much mixed; but only the American is as mixed as the Turk. In the case of these last two the mixture has taken place comparatively recently and hence ought now to be producing its maximum effect. Yet the results in America and in Turkey are as diverse as can well be imagined. The Turkish mind is sluggish, while the American mind, whatever its other faults, can certainly not be accused of lack of alertness.

We have seen that whether variations in a species arise from spontaneous variations or from the mixture of races their preservation and the consequent evolution of new types is largely, although indirectly a matter of environment.

Following still the same line of thought, let us examine the position of biologists as to the direct action of environment upon evolution, the third of the theories advanced in explanations of the origin of races. Darwin and his immediate successors thought that physical circumstances were competent directly to stimulate organic changes which would adapt the individual to its peculiar circumstances. Later this view was disproved and the pendulum swung far into the opposite extreme. Now, as usual, opinion is settling to a compromise. No one doubts the importance of the influence of physical environment, especially climate, in weeding out certain characteristics and encouraging others. The horses of Arabia are slender, fleet and able to endure the lack of water because animals not possessing these traits have gradually been killed off by the harsh conditions of the desert. The horses of the Shetland Islands, on the contrary, are short, stout and hairy because this particular type does not suffer injury from the cool damp climate. In this case we have no reason to suppose that the effect of climate extends beyond the selection of the type best fitted for preservation. The colts that were not slender and fleet died in the desert and those that were not plump and hairy died in the islands. Beyond this, however, lies a deeper question. Can a change of environment induce a direct change in bodily form and functions? And if so, does that change become permanently heritable? Recent research seems to answer these questions in the affirmative. Exact observations, indeed, are not numerous, but some of them are convincing, at least so far as plants and animals are concerned.

One of the best examples of a permanent and heritable change due to changed climatic environment is found in a species of *Capsella* or shepherd's purse growing in Asia Minor. In the relatively moist lowlands close to the coast the plant has broad leaves, whitish flowers and stems 10 or 12 inches high. A highway leads from these regions to a plateau at an altitude of 6000 feet or more. Up this the seeds of the plant were apparently long ago carried by man and his animals; and now in the elevated habitat the plant has taken on certain alpine characteristics, including elongated roots, xerophytic

leaves, stems only one or two inches high, reddish flowers and a general increase of hairiness throughout the entire plant. When seeds are taken from the lowland and planted in the upland, as Zedbauer has found, the first generation of young plants possesses all of these new qualities. This is not surprising, for it is a matter of common observation that plants vary greatly according to the soil and still more the climatic conditions in which they are placed. The important point appears when the seeds of the plants which have been long in the upland environment are taken to other places, such as Vienna, where the climate is not at all alpine. There the new plants continue to show the characteristics of the upland environment. Slight changes indeed occur; the stems become an inch or so longer; the roots change to an equal extent; but the flowers and leaves retain practically all of the alpine characteristics. When the plants were cultivated for four successive generations in Vienna no further change was apparent. In this case therefore, it seems impossible to avoid the conclusion that a change of climate induced pronouncedly new characteristics which another change of climate was not able to eradicate. That more such changes have not been observed seems to be due chiefly to lack of accurate observations upon species which have long been subject to a new environment.

Among animals similar phenomena have been observed. For instance Sumner found that mice reared in a warm room differ considerably from those reared in a cold room in the mean length of the tail, foot, and ear; and these differences were transmitted to the next generation. These facts have an additional importance because the differences were exactly those which distinguish northern and southern races of many animals. Further examples of a similar kind might be given, but enough has been said to point out the general trend of some of the most interesting of recent biological experiments. Among man it is probable that similar results follow upon changes of environment. For instance statistics show that the descendants of English colonists in Australia average taller than the English in general, and that they are slighter in proportion to their height, a difference

closely analogous to that between the slender desert horses of Arabia and the plump ponies of Shetland. In America still more surprising results have been found. Boas has recently made measurements upon the American-born children of Jews from central Russia and Italians from Sicily. In the case of the Italians, who are long-headed, the children appear to be shorter-headed than their parents, while among the Jews, who are notably broad-headed, the children have longer heads than their parents. In other words, under the changed environment both alien types seem to take on new characteristics and to approach a type normal to the new environment. The results are so at variance with all the established conceptions of ethnologists that they have been received with much scepticism. Nevertheless there is no more reason for doubting that flowers can take on a pink tint in alpine surroundings, or that mice can have longer tails in hot countries than in cold, than for doubting that the bodily form of the human race can change. And if the bodily form can change, there is equally great probability that the mental character can alter.

Before leaving the subject of the evolution of new characteristics and new races by means of changes in physical environment, it may be well to sum up the matter in accordance with the conclusions of MacDougal in an article upon "Organic Response," published in the *American Naturalist* for January, 1911. It seems to be proved that morphological and physiological changes in both plants and animals can be occasioned by changes in geographical environment. So far as outward manifestations of form are concerned these changes take place quickly; that is, they appear in the first generation which grows up in the new environment, and do not vary greatly thereafter. Among animals the change may be somewhat slower, and it is also possible that internal variations in functions may take more than one generation for adjustment to the new conditions. The changes whether in form or function are not necessarily useful. They may indeed be distinctly injurious and may lead to the extinction of the species. Changes of the kinds here considered have been proved to be transmissible from parents to off-

spring, and herein lies the most important feature of the whole matter. It appears, however, that the new environment must have an opportunity to work upon the species for several or perhaps many generations before the new characteristics become permanently heritable and the transplanted forms can be considered as capable of forming a new race.

In this discussion of biological principles we seem to have wandered far from the Japanese, but this is by no means the case. In so far as man is the crowning product of biological evolution he must be subject to the same laws as are plants and animals. So far as physiological processes are concerned we accept this conclusion absolutely. No intelligent person hesitates to allow the vaccine of a cow to be placed on his arm and to spread through his blood. We believe that the experiments made upon guinea pigs have a direct bearing upon problems of human physiology: and we talk calmly of the possibility of grafting the eye of a rabbit into the socket of a human being. In all these things we proclaim in the most positive fashion our faith that the biological laws governing animals and man are the same. When it comes to the brain we acknowledge the same thing, although not quite so readily. Doubtless the human brain has capacities far beyond those of any other terrestrial creature, but even when we make this claim, we talk to a dog and are convinced that he remembers certain words and attaches to them the meaning that we do.

If we accept the conclusions set forth above we are led to the following conclusion in regard to the Japanese. The mental alertness of the Japanese, the quality wherein they differ from most of the rest of Asia and approach most nearly to the people of Europe and of North America north of Mexico, must have arisen from one of the three causes mentioned at the beginning of this paper, that is from spontaneous variations, from the mixture of races, or from the direct action of geographical and especially climatic environment; but however it may have arisen, its preservation is owing to the presence of favorable geographic environment. I know that this statement is sweeping, but it should be understood

that I do not advance it as something already proved but merely as the tentative conclusion to which we are led if we adopt the hypothesis that man's brain as well as his body is subject to the laws of biological evolution, and if, in addition, we accept some of the latest, but as yet not universally accepted biological conclusions.

With the understanding then that we are merely testing an hypothesis and not pretending to deal with proved facts, let us see whether there are any features of the geographic environment of Japan which lend support to our theory. The most important geographical characteristics of Japan are first its insular character and its position off the populous east coast of Asia; second, its mountainous topography and limited area of arable land; and third, its moist, variable climate. A score of other minor factors might be added, but I pass them by for lack of time.

The insularity of Japan can here be discussed but briefly. Many authors have dwelt upon it, and its importance is universally recognized. Because of their constant and intimate contact with the sea the Japanese are skillful sailors, and in the future are likely to play a prominent rôle in the world's naval history. Moreover the surrounding seas render Japan comparatively safe from hostile attack, and thus free it from the necessity of constant watchfulness; and great armies like those of France, Germany, and Russia are unnecessary. The seas have thus done for Japan essentially what they have done for England, save that Japan, coming late into the comity of nations, has not been able to secure vast tracts of unoccupied colonial territory. Important as this is, I believe that there is another respect in which the service of the embracing ocean to Japan has been even greater. However the energetic quality of the Japanese mind may have originated, there can be little doubt that its preservation has been facilitated by the separation of the island from the mainland. China has suffered again and again from being overrun in the northern parts by Tartars of various tribes and by Manchus or other people from the unproductive lands of the north and west. Korea in the same way has been subject to a constant influx of Chinese

while in the other countries of Asia from Turkey to India the coming in of alien races has been on so large a scale as to be the dominant element in their history. Such migrations have produced two noteworthy effects. In the first place the wars and misery attendant upon them have often not merely checked the progress of civilization for long periods, but have actually caused retrogression as in Persia. In the second place, where no such evil results have followed, there has nevertheless often been a great change in the direction of progress, a fact well illustrated by the consequences of the great Teutonic migrations in Europe. Suppose that Japan had been exposed for two thousand years to the unchecked invasion of the races from the neighboring parts of Asia. What would have been the result? Her people today would not be the race that we now know, but a composite mixture, probably more akin to the Chinese than to the present Japanese. The chances are that, unless physical environment is responsible for character, the race would possess the relatively inert, and highly conservative qualities of the continentals rather than the alertness of the islanders. By shielding the Japanese ever since the time when their present characteristics first became evident the insularity of the country has been of the highest service. It has allowed essential traits to be preserved unmixed and to develop until now they are a permanent acquisition. The course of history seems to show that races develop marked and peculiar characteristics and bring them to perfection and fruition only in relative seclusion where they are free to evolve their own ideas and character without constant hindrances from without. It was so with the early Greeks: the Hebrews of Judea, to whose later dissemination we owe practically all that the Jews have contributed to history, dwelt in a seclusion sharply in contrast with the cosmopolitan life of their kinsmen in Samaria and the rest of Palestine, and were preserved for century after century by the inaccessible character of their plateau: and the English have been able to make so marked an impression upon history in large measure because of their long isolation in their tight little island. Thus it has been with Japan: Chinese have come into the

country and so have Koreans, especially in the period from the fourth to the seventh centuries, but never in such numbers as seriously to alter the racial composition of the people of the islands. To be sure the Japanese adopted Chinese methods in the seventh century as they have adopted those of Europe in the nineteenth, but in neither case did this mean an appreciable alteration in race, or a change in fundamental character. Thus for two thousand years the insularity of the country has permitted it to pursue its way almost without respect to the rest of the world; the original racial characteristics which were in harmony with physical environment have been preserved and fostered, while others have been eliminated by the inexorable process of natural selection, until today the Japanese as a people are probably adapted to their environment more perfectly than is any other leading race.

The topography of Japan is almost if not quite as important as its insularity. Used in the broad sense this includes not only the relief of the mountains, plains and valleys, but also the character of the coasts and their indentations, and a large number of other features. From among the many qualities of the Japanese race which have been preserved and fostered by the conditions of physiographic environment constant and almost tireless industry stands out as one of the most widespread. By reason of the highly mountainous character of the country only from one-sixth to one-eighth of its area is now considered fit for cultivation. A thousand years ago a far smaller area appeared capable of utilization. When the growing number of the Japanese race at some early date seemed to threaten over-population several courses were open to the people, although they themselves were quite unconscious of the matter. One possibility was emigration, but this seems to have been resorted to very rarely because, until the advent of modern means of communication, the insularity of the country was as effective in keeping people in as in keeping others out. Another possibility open to the increasing numbers of the Japanese was the method or lack of method characteristic of India. There the population goes on increasing at a rapid rate until famine, pesti-

lence, or war arises and sweeps off the surplus swarm of human beings like flies in autumn. Before the coming of the English, a hundred famines and pestilences never, so far as we can tell, stirred the native population to any new exertions or to the invention of new methods. A condition of mental apathy seems to have prevented or stifled all initiative. In Japan, as also in China, quite a different mental attitude prevailed, and a third and highly rational method was unconsciously adopted in order to meet the dangers of over-population. As the means of supporting life decreased relatively to the number of people, industry and economy increased. Among the people of India few or none seem to have possessed the mental qualities which incited them to struggle against the ills of increasing poverty and scarcity of food, or at least few struggled with success. In China and Japan the number who thus struggled was large, and their success was great. Thus the Chinese and Japanese acquired the admirable qualities of industry and economy or rather those members of the community who possessed them were able to rear strong healthy children who inherited the parental tendencies while the children of the idle and extravagant grew up weak in body and were gradually eliminated.

Thus far the conditions of Japan and China appear to be alike. Now, however, we come to the influence of topography which together with climate seems to have been against the Chinese. The people of that sturdy race, in spite of their hard work and sparing lives have never been able to overcome the great natural disasters to which their country is subject. Throughout a large portion of China the winters are practically rainless and the crops depend upon the monsoon rains which normally begin at some time from April to June according to the latitude. Often the rains are delayed so that the crops of the great body of farmers who do not depend upon irrigation are ruined. Then when the rains finally come they fall with extreme violence, just as they do with us after a long drought, but even more severely because of the height of the mountains which border China on the west. The steepness of the mountains sheds the water at once causing enormous floods of a magnitude

which it is hard for us to understand. When the waters reach the lowlands another physiographic feature, the vast level expanse of plain, causes the rivers to spread over thousands of square miles as has happened in recent years in both the Yangtze and Hoangho basins. The crops of millions of farmers who dwell in the great flat plains and use the water of the rivers for irrigation are thus ruined. The inevitable consequence of the combined droughts and floods is famine involving tens of millions of people. This not only works terrible havoc in the districts immediately affected, but bears severely upon all the surrounding areas. Hundreds of thousands of people, homeless and penniless for the nonce, wander hither and thither over the face of the land, begging where they can, stealing and plundering when begging fails to afford a living. The result is that initiative and individual progressiveness are discouraged. A man's ability in improving his conditions has little to do with the chances which he runs of falling into trouble. No one man, nor even a whole village, however energetic it may be, can do much to avert a famine which directly affects 20,000,000 people. Thus there is very little selective action. The man who is industrious is assuredly better off than his neighbor in ordinary years, but the man of a progressive turn of mind, the one who introduces improvement and by long labor carries them to fruition is no better off than his neighbor when the time of distress arrives. If the rain does not fall to replenish the brooks no amount of ditching and terracing will furnish the children with bread; and if hordes of starving refugees pour into a region, they are more apt to rob the prosperous than the poverty-stricken. Thus the very size of the Chinese mountains, rivers and plains, and the vastness of the disasters to which the land is subject have been a factor in promoting the inertia which is so prominent a trait of Chinese character, and which is the danger of every race unless there is some strong means of counteracting it.

In Japan conditions are quite different. Industry and economy are at a premium just as in China, but energy in reclaiming new land or in adopting new methods is also at a premium. Japan is of course subject to great disasters

in the shape of famine, flood, fire, and storm, but these are never on the Chinese scale. The form of the land and its position prevent this. The rivers are all small and the area that can be flooded by any one of them is strictly limited. Similarly, disastrous droughts occur, but are never so devastating as in China. Japan, by reason of its mountains and of its position off the coast gets heavy rains, and these may be much diminished in dry years, but never so that the crops are absolutely ruined. There is never that completeness of failure which is so sad in China. Trouble and distress may come, but they are always accompanied by a ray of hope. A man who reclaims an acre of land on the side of the mountain knows that even in the worst years he will reap a crop of some sort from it. Occasionally, during past days of misrule, he may have suffered loss from the people of a neighboring district who were wandering abroad by reason of distress at home, but this fear does not hang over him with a tithe as much force as in China. In a word, not only do the qualities of industry and economy reap as great a reward in Japan as in China, but because of the small scale of the country and its topographic diversity energy and initiative are fostered, and the children of alert-minded parents have a better start than those who are sluggish.

I have reserved climate, the most important of geographic factors until the last. Already, to be sure we have been led into the discussion of the subject in connection with floods and droughts. Beyond this, however, lies a more interesting and more debatable field of research. Buckle has been laughed at and discredited because of his sweeping generalizations in respect to the influence of climate upon history and character. Doubtless he made absurd blunders, as every man with a great idea is bound to do. Yet if he were alive today and could weigh the new evidence which is continually being brought to light, I believe that his main contention would still seem to him true, and in the end I think it will be accepted by the world as a whole. In a nutshell his theory was that physical environment determines the character and achievements of all the races of the world, and that climate is the most important of all the elements of

physical environment. Such a theory, whether right or wrong, well deserves consideration. To dismiss it after the fashion of some writers, as a "blanket theory" unworthy of further study is as unscientific as to accept it without proof. In the remainder of this article I propose to present two lines of evidence which seem to show that the climatic conditions of a country have far more to do with the mental condition of the inhabitants than is generally recognized. This is far from meaning that climate is the only factor. No one would claim for a moment that any climatic conditions, no matter how extreme, could overcome the influence of the inheritance derived from thousands of generations of ancestors. The most that is assumed in the present hypothesis is that climatic conditions can and do slightly modify inherited characteristics, just as we know to be the case in plants and animals, and that in course of time the conditions of any particular environment will pick out such variations either for preservation or extinction.

The general relation of climate to the energy and ability of races is too well recognized to require much consideration. Of the 50,000,000 square miles of the earth's surface which consist of land lying outside the limits of the polar circles approximately half lies within 30 degrees of the equator. Yet, as Ireland has pointed out, from the races which are indigenous to this vast area or which have dwelt in it long enough to have been much modified by it there has never arisen any man except Mohammed who has the least claim to a place among the world's leaders. Gautama, the founder of Buddhism, although a native of India, was born and reared among the Himalayas almost exactly 30 degrees north of the equator. The great men of ancient Egypt, Ramses and his countrymen, lived for the most part in the Nile delta, which lies north of 30 degrees. Even Thebes, at the southernmost limit of the important portion of ancient Egypt lies only 4 degrees farther south. Similarly in America, Diaz, the only Latin-American with a world-wide reputation is in reality a product of Spain, not of Mexico.

Clear as the relation of climate and human achievement may be when the temperate and equatorial regions are

compared, it becomes much more complex when comparisons are instituted between the various countries of the temperate zone. Let us limit ourselves to the northern hemisphere, since the amount of land in the southern is small and the people there are largely recent immigrants. We may divide the north temperate zone into two belts, one extending from latitude 30 to 45 and the other from 45 degrees to the Arctic circle. In the more southern of the two belts we find countries occupying most diverse positions in the scale of civilization. On one side of the Pacific stands our own country in the forefront of progress, while on the other Japan faces us on equal terms and in some respects beating us at our own game. Half way back to America as one continues around the globe, lies Italy, one of the world's great powers, but noteworthy for the marked difference between the energetic, capable people of the northern parts and the unstable, mercurial inhabitants of the south around Naples and in Sicily.

None of the other countries in the belt between 30 degrees and 45 degrees have any claim to a place among the world's leaders. Spain, Greece, and Turkey are second rate powers whose limited modern achievements suffer sadly by comparison with the past. Servia, Bulgaria, and Roumania deserve praise for what they are accomplishing, but in comparison with countries of similar size such as Switzerland, Belgium or Holland, they are far below the first rank. From European Turkey and the vicinity of the Aegean Sea south-eastward the condition of the Turkish Empire becomes steadily more hopeless, not so much because of more war and misrule than in the Balkans but because the people are more apathetic. Persia, which lies for the most part between latitudes 30 and 40 resembles Turkey very closely in this respect and in many others, but its general condition is decidedly lower. Morocco and Tripoli are, if anything, worse off than Persia, and this low level is maintained in Afghanistan and Tibet. I omit Algiers, Tunis, and Egypt, because their present prosperity is due entirely to France and England. Finally we come to China where conditions again improve over those in Central Asia, and are in many

respects about as advanced as in Turkey. In the face of such a congeries of nations it is manifest that latitude and mean temperature have practically nothing to do with a country's position in the scale of civilization. The countries in the belt under consideration stand decidedly higher than those of equatorial regions; and in this we can probably see the influence of lower temperature, and of greater variations from the mean temperature. The constant recurrence of winter with the accompanying necessity for forethought and industry in order to have means of subsistence was probably one of the chief factors in originally advancing the temperate zone faster than the tropics.

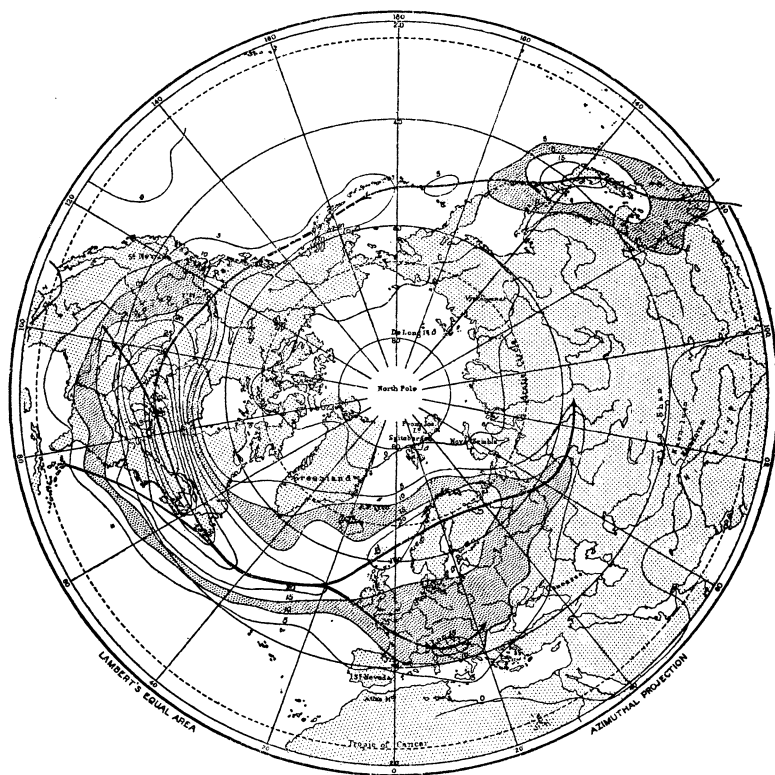
Turning now to the most northerly belt of nations we find that on the whole they stand much higher than those to the south of them, but here, too, there are great divergencies. Canada, Great Britain, France, the Netherlands, the Scandinavian countries, Germany, Switzerland and Austria all stand in the front rank. So, also, does Russia in many respects. Finland, the Baltic provinces, and the northwestern part of the country in general doubtless deserve a position well up among the nations. Southeastward, however, toward the Caspian Sea and in the Asiatic provinces of Turkestan there is a great falling off. The indigenous inhabitants of those regions occupy a position not far removed from that which prevails in the better parts of Turkey. East of the Urals in Siberia a similar phenomenon prevails. The western part of the country is fairly progressive and is filling up with Russian colonists after the fashion of the western plains of the United States and Canada. In the vast eastern half stagnation prevails. The native races are inert and unprogressive, Russian influence is able to penetrate but slowly, and we have no assurance that much progress is ever to be possible.

The attempt to find some common factor or factors which should explain the predominance of certain nations and the differences between nations living as close to one another as Japan and China or Austria and Turkey has hitherto met with little success. The facts in regard to Japan seem to make it evident that these differences are not a matter of

religion: only by a series of unproved though interesting hypotheses can they be ascribed to the presence of any particular race: and conditions of temperature and rainfall, or the succession of the seasons,—that is the features of climate, as ordinarily understood,—furnish equally unsatisfactory explanations. A few writers have thought that one of the chief factors in explaining racial differences might perhaps be found in the degree of variability of the climate in the respective countries. They point to the fact that in general mankind is most progressive in places where there is not only a marked difference between summer and winter, but also where there are frequent variations from day to day. The writer has pointed out that one reason for the difference between the sluggish character of the people of western and central Asia and of countries like the United States may be the number of storms. All through the summer months in large portions of Asia rain is practically unknown; and even in the autumn, storms come so slowly that there is no sudden change. In the United States the farmer and everyone whose work is out of doors is forced to be constantly on the watch to guard against the exigencies of the weather. If the hay is down the farmer must be ready to work furiously in order to get it in before a threatened storm arrives: in the fall the prospect of a frost often urges him to work at a rate which he would never think of otherwise. Thus for generations, not only in America, but in western Europe where conditions are similar, the farmers or other out-of-door workers who were not alert and were not so constituted that they could and would make strenuous exertions, have been at a great disadvantage. They have tended to grow poorer and poorer and gradually to sink into the lower stratum of society where the children are ill-nourished and die for the most part before reaching maturity. In the almost stormless lands of Asia, on the contrary, no such stimulation and selection take place. The harvest is finished during a period when the farmer is practically certain that no storms will come up to injure it. In the fall the cold weather approaches slowly and gradually, and there are long warnings before the breaking of the first harmful storms. Hence the

man who works deliberately is quite as well off as the one who is alert and active.

In spite of hypotheses like the one just given, the relation of changes in the weather to the advancement of civilization has till now been a hazy matter. It remained for Professor C. J. Kullmer of Syracuse University to formulate a brilliant hypothesis which at a single stroke opens a place for hundreds



of hitherto unrelated facts. The reasonable nature of the hypothesis is so obvious when once pointed out, that it scarcely seems credible that the world should have so long been blind to it. The accompanying figure shows a map of the northern hemisphere with the north pole in the center. Upon it has been plotted the frequency of cyclonic storms. The term cyclonic storm in the vocabulary of the meteorologist does not mean something severe like a tornado, but

merely the ordinary type of storm prevalent in the United States and Europe. The storm consists essentially of an area of low pressure which may be a thousand miles in diameter, and which moves across the country with a general easterly trend. Winds from all sides blow obliquely toward the center. On the east side, or in front of such a storm east winds prevail, while behind it the movement of the air is from the west. In the central parts of the cyclonic area the air is rising because of the low pressure, clouds are formed, and rain falls. Storms of this type, as everyone knows, are our main source of rainfall throughout the year. In other parts of the world, for instance in the tropics or in the monsoon regions of northern India and most of China the rainfall does not come from cyclonic storms but from brief showers often accompanied by thunder, but not characterised by large areas of low pressure. During the course of a thunder-shower or of the other showers which produce rain in such regions the barometer may fluctuate rapidly for a few hours, but in general it remains steady.

The cyclonic storms of temperate regions move in well-defined tracks which are observed and mapped by the various weather bureaus. From the data thus furnished it is a simple matter to insert on a map the average number of storms whose centers each year pass through a given area. In the present case the unit is a rectangle five degrees long on each side. The number ten on the map means that on an average, during the years for which the data have been examined by Dunwoody, the centers of ten storms passed over all points on the line, while the edges of many more storms passed that way. Inside the line the number of storms increases, while outside the number decreases.

Examination of the map, as Kullmer points out, shows at once that the area included within the line of ten storms embraces all the leading countries of the world. North America possesses the area of maximum storm frequency with its center in southern Canada, while the region of abundant storminess extends over all of the United States except the far south and southwest. In Europe the chief countries all come within the line of ten storms, Great Britain, France,

the Netherlands, the Scandinavian countries, Switzerland, Germany, Austria, Italy except for the southern part, and finally the northern and western portions of Russia. Most significant of all, Japan, the one country of Asia which rises to the European level of achievement, is the only Asiatic country subject to frequent cyclonic storms.

The remarkable case of Japan has been seized upon by Kullmer as the strongest possible reason for believing that the storm track hypothesis offers an adequate explanation of the peculiar distribution of intellectual attainments among the nations. It may be that the Chinese, as many authorities hold, are possessed of as great mental ability as the Japanese or any other race. Kullmer's hypothesis does not attempt to settle the matter. It merely postulates that the occurrence of storms is a mental stimulant, and that this stimulant does not now apply to China. Those who have most faith in the Chinese often say that that race is the equal of any in the world, but they are forced to add that this is not now apparent because the Chinese have not yet waked up. Perhaps contact with other races will wake them up, but of this we are not sure. Once they were awake, two thousand years ago. That was when the Greeks were awake and the Jews and other people of the ancient empires. In those days, apparently, storms were more frequent than now in the countries which have gone to sleep. I cannot here go into the matter of changes of climate, but years of work in Asia and recent investigations of ruins and lakes and of the rate of growth of ancient trees in America have convinced me that pronounced changes of climate have taken place both in the eastern and western hemispheres. The changes thus inferred are of exactly the kind which would increase the storminess of the parts of the world where civilization has decayed.

An hypothesis such as this of the relation of the storm track to civilization needs severe testing. Kullmer has begun to test it by comparing bank deposits and other evidences of thrift and energy in various parts of America, on the one hand, with the number of storms on the other hand. Another method lies in measuring the direct effect of cyclonic

storms. As yet only a beginning has been made along this line. Lehmann in Copenhagen made measurements of the strength of three individuals for over a year and reached some interesting results. He found that during the half year from the end of November to May, as he puts it, or from October to May, as his curves show, muscular strength increases with a rising barometer and decreases when the barometer falls. During the other half of the year he detected no direct relation, possibly because his observations were interrupted by a journey, possibly because of the method used in averaging the work, and possibly because there is no direct relation at that time. An examination of his curves, however, shows frequent cases of a direct relationship at all seasons. The fact probably is, that the relation exists at all times, but in the summer and autumn when barometric changes are less marked than in winter and spring, changes in the strength of human beings because of that cause are masked by other variations due to temperature and the incidental matters of occupation and health which are continually influencing mankind. Strangely enough Lehmann's work seems to show conclusively that although the small barometric changes connected with cyclonic storms produce a direct effect upon the strength of the human body, large changes such as those involved in a change of residence from sea level to an altitude of two or three thousand feet produce no corresponding effect. The bodily functions become adjusted so quickly, especially in the case of an ascent that no disarrangement or diminution of strength occurs unless the altitude becomes sufficient to interfere with breathing. Lehmann made a short series of tests to determine the relation of mental as well as physical activity to the barometer. His methods were not accurate enough to give positive results but he concluded that in general the condition of the mind varies with that of the body, and hence that the brain is stimulated by a rise of pressure.

I have had the good fortune to be able to test this matter further and by means more accurate than those employed by Lehmann. Professor J. McK. Cattell of Columbia University made a series of tests upon three children daily

for an entire year, and thereafter weekly for another year. Each child wrote out on the typewriter the first stanza of Spenser's "Faerie Queen" each day, and then copied a new page from the same poem. The length of time for each operation and the number of errors in copying the stanza that was repeated daily were recorded. Thus in three ways, speed, accuracy, and memory, it is possible to test the children's state of mind. Professor Cattell's purpose was the determination of the rate and manner in which skill in the use of the typewriter increases. His figures, however, are equally useful for the purpose of comparison with the changes of weather, and to this end he has kindly put them at my disposal. The results are unmistakable even in the present incomplete state of the calculations. In spite of the hundred and one accidents which might influence the children's minds, the effect of the barometer is clearly apparent. In one case an individual curve for more than a month runs almost absolutely parallel to the fluctuations of the barometer. In other cases a seeming disagreement turns out on closer examination to be a striking agreement. For instance in one instance the combined curve of all the children, that is the average of all, falls for a week, showing that sickness or colds or some other undefined cause was at work slowing them up. The barometric curve keeps on in its usual sinuous course and at the first glance seems quite unrelated to the ability of the children to write rapidly and accurately. Nevertheless the relationship is there. The children's ability decreased, as has been said, but not steadily. Each time that the barometer rose, the fall in the children's ability was checked, so that the line for that day slopes only very slightly, while on other days when the barometer was falling the children's line drops rapidly. On the whole the agreement between mental activity, including speed, accuracy, and power of memory is so close as to be beyond question. For generations we have been talking about the weather and its influence, and now it appears that we can actually measure the amount of additional work which a man can do because of the passing of a storm. Other elements, such as temperature, humidity, and sunshine play

an important part, but the dominating influence appears to be changes in the barometer. Why this is so we can only guess. The fact remains that in the only cases where it has been tested it is true, and the more rapid the succession of storms the greater is their influence.

Probably the relation between mental work and atmospheric pressure is analogous to that between the growth of plants and temperature. Each species of plant has a certain optimum, or temperature most favorable for growth. Nevertheless a plant is not helped by being kept permanently at that temperature. It will grow far better if the air is sometimes cooler and sometimes warmer than the optimum. Repeated fluctuations back and forth from day to day or between day and night are the most stimulating conditions, provided the average temperature is not far from the optimum and the departures from that point are not too great. Apparently something similar takes place in the human brain. Day by day the brain, especially in childhood it would seem, is alternately stimulated and checked. The checks give rest, the stimulus creates or encourages the habit and capacity for strenuous exertion. Some brains are doubtless more and others less sensitive to such barometric stimuli. In a country of uniform conditions and slow changes like Central Asia or the tropics neither type would have any special advantage. In a country like Japan characterized by frequent changes the brains susceptible to the stimuli would work actively and certain individuals by means of greater power of thought and action would succeed while those who were not subject to the stimuli would be worsted. Thus, it would seem that in Japan a certain type of mind has been selected and preserved by reason of the stormy climate. The type is the same as that which prevails in western Europe and North America, and quite different from that of the rest of Asia. If this is so, it is most fortunate for Japan. For China and for many other nations it may seem unfortunate, but perhaps the future is not so dark as would appear. The knowledge of a disease is the first step toward the remedy. If the mind needs a stimulus, science must invent one.